

Aerodynamic investigations on the Profile PK121-3 in the RWT (Regensburg Wind Tunnel)

Michael Zinner

e-mail: zinner0381@web.de

Fachbereich Maschinenbau, Galgenbergstr. 30, D-93053 Regensburg, Leiter: Prof. Dr.-Ing. Stephan Lämmlein
http://www.fh-regensburg.de

Introduction

The object of this thesis is the design, construction and conversion of a test set-up to measure the pressure distribution above and below a the wing PK 121-3 to determine and to convert this then in cp - value course.

In addition it is necessary to develop suitable software which determines the different pressure, angles of attack and the wind tunnel data and can store this.

A profile was made for it out of high-grade steel. On these are the small holes have to be positioned that these have mutually no influence on each other. This profile must be positioned in the closed measuring distance of the wind tunnel and the angle of attack must be able to chance.

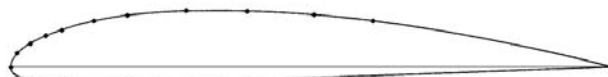


Abb.1: Position of the small holes around the profile PK 121-3

Realization

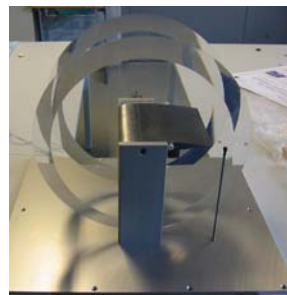


Abb.2: wing PK 121-3

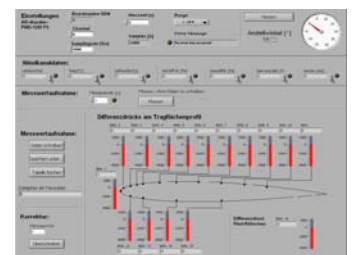


Abb.3: Ausschnitt LabView Messprogramm

The wing owns 15 small holes vertically to the surface where we can measure the pressures. This pressure can be measured with the help of the PSI 9016 and the angle of attack with the A/D converter which is connected in the potentiometer. The wind tunnel data comes from the COM port.. The illustrated LabView program can take up the measuring values and store them.



Abb.: A/D-converter



Abb.: PSI 9016

Focus of Investigation

The aerodynamic lift and drag can be determined by the pressure distribution around the wing. But in our wing are not enough holes. So we can only appoint the cp-values.

The cp - value which is often called also pressure coefficient is a size without dimension from the aerodynamics which often comes with the interpretation and the analysis of wings. But also in other areas of the aerodynamics, e.g. with inside currents.

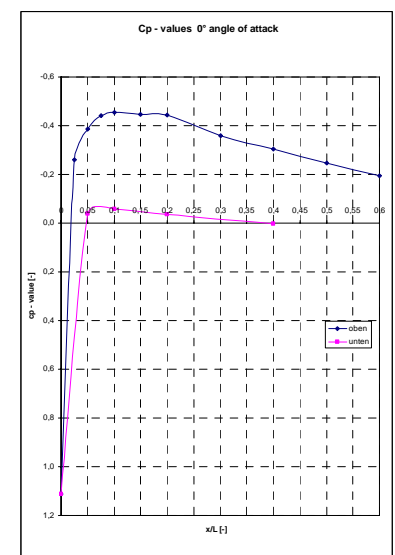
Among the rest, it is used to describe the pressure distribution on the wing of airplanes or to explain it graphically. One understands by the pressure distribution the pressure on all points on the whole surface of the wing. Covered to a certain point the cp - value is the relation between the static and dynamic pressure.

Conclusion

The measured pressure is stored away in an Excel file and is converted afterwards into the cp - value without dimension .

$$c_p = \frac{p - p_\infty}{\frac{\rho}{2} u_\infty^2}$$

The cp - value typically is applied as a function of the profile length in a diagramme. In the accompanying diagramme can be recognised that this profile already with 0° angle of attack already generate a lift.



References:

- Kubbat, W.: Flugmechanik 1, TU-Darmstadt: 1991
- Thomas, F.: Aerodynamik 1 (Profiltheorie), UNI Braunschweig: 1971
- Schlichting / Truckenbrod: Aerodynamik des Flugzeugs, Springer:1967
- Katz, J.; Plotkin, A.: Low-Speed Aerodynamics, Cambridge Aerospace Series: 2001
- Lämmlein S.: Vorlesungsskript FAE, FH Regensburg: SS 2006
- Lackinger, Ch.: Richtungsabhängige Strömungsmesssonden für kleine Strömungsgeschwindigkeiten, Diplomarbeit LWS-DA-05/19, FH Regensburg: 2005